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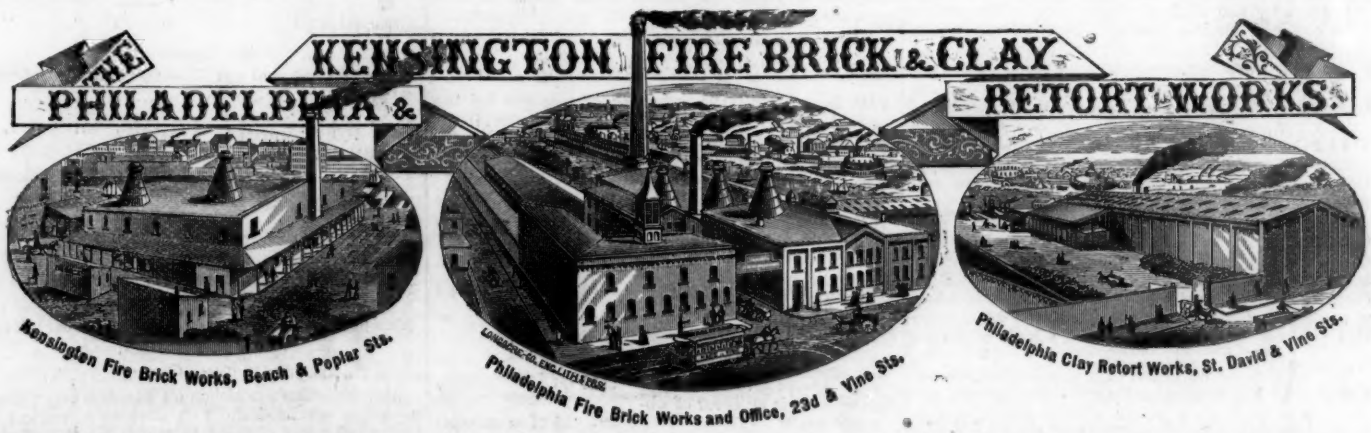
THE PHILADELPHIA & KENSINGTON FIRE BRICK & CLAY RETORT WORKS.
Kensington Fire Brick Works, Beach & Poplar Sts.
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Philadelphia Clay Retort Works, St. David & Vine Sts.

Philadelphia Fire Brick Works.

The use of Clay Retorts having now been openly recognized and adopted by the principal Gas Engineers in this country and abroad, it remains with the manufacturer to do his best in turning out an article that will give the satisfaction which is expected of them. The simple fact of forming a quantity of clay into a Retort, does not ensure its being at all adapted for the work it has to do. To get up a good Retort, the party manufacturing must know thoroughly the functions it has to perform, and to know this, must have a practical knowledge of the workings of them, so as to guard against the accidents likely to occur in the heating up and cooling off a bench. These can be avoided to a great extent by the proper manipulation of the clays, care, and having a knowledge of the action of the gases upon the retort. The using a suitable clay, will prevent the carbonizing of the retort to such an extent, that the difference between iron and clay in this respect is not much: and this without the use of an exhauster. We know that in one of the principal works in Virginia, where they have an exhauster they do not use it, and the Superintendent cannot see that it makes any difference, as regards the accumulation of carbon, or the quantity of gas extracted.

Mr. Philip Newkumet, a cut of whose extensive works adorns our front page, has devoted himself for a number of years to excel in this manufacture, and we have no hesitation in saying, that he at present turns out a Retort that cannot be surpassed in durability—the "Belgian" not excepted. His retort shops are said to be the largest in the country. We had occasion some time ago to make mention of them. Some of the principal Gas Works in the country are supplied from these works. Among others may be mentioned the clay retorts for the People's Gas Works at Newark, N. J., constructed by the eminent contractors, Messrs. Hoy Kennedy & Co., New York. Mr. Newkumet guarantees all the goods that leaves his establishment. Plans of working benches of threes, fives, and sixes, are furnished free of charge, upon application. Parties who are desirous of introducing Clay Retorts into their works, would do well to place themselves in communication with Mr. Newkumet, or his agent, L. M. Noyes. The latter gentleman has visited almost every gas work in this country, and has gathered valuable information whereby some of the difficulties of working clay benches have been easily overcome. Mr. Newkumet will be happy to have superintendents and others interested in this matter, call upon him. The works are convenient to the American Gas Meter Company's Works. He has certain manufacturing advantages, which he thinks, will permit him to turn out Retorts, etc., at a price unusually favorable to those who choose to patronize him. Mr. Newkumet also makes a specialty of Sugar-house Retorts. The office of the Philadelphia Fire Brick Works is at the corner of Vine and Twenty-third streets, Philadelphia, Pa.

To Prevent Water from Becoming Putrid.

Theoretically the application of chemistry to the numerous necessities of daily life, and to the cure of diseases which afflict the human system, would seem to be illimitable. Practically, however, it is found that the human stomach cannot be used in all cases as a chemical laboratory, and the applications of chemistry to daily life do not always confirm the promises of theory. Hardly a day passes, however, without some new application of chemical science which is of real value to mankind.

We have noticed recently a very simple discovery, but one of daily practical utility. It is to prevent water from becoming putrid, and is founded on the principle that iron becomes rusty only in water that contains air. It is the oxygen of the air, contained in the water, that unites with the iron and produces rust.

So, also, the rusting of iron in water removes the oxygen of the air from the water. But water in which there is no oxygen or atmospheric air cannot become putrid. To prevent water from becoming putrid, we have, therefore, only to put in it some bits of iron. Some pieces of sheet-iron (not rusty) or iron turnings are the best. Cast iron is not so good.

The practical applications of this are numerous. Drinking-water on ships may be kept sweet by putting it in sheet-iron tanks, or by putting bits of iron into the water-casks. Water in which leeches are kept will remain sweet without changing it, by putting a few scraps of iron in the vessel. The offensive smell from the water in the vases of flowers will be prevented by a few small nails, or bits of sheet-iron in the bottom of the vases. The putrification of water, so common in the bottom of rain water cisterns, would be prevented by scraps of iron or iron-turnings. In this case, it would be well to put the iron where it would not be disturbed. Perhaps if inclosed in a loose bag or net, it would be well. Other applications of the principle will suggest themselves to our readers.—*Providence Journal.*

THE SALES OF GAS effected by the Belgian General Company for Lighting and Heating by Gas in the nine months ending May, 1870, inclusive, amounted to 296,521,484 English cubic feet, against 278,298,206 English cubic feet in the corresponding months of 1868-9. There was thus an augmentation of 18,223,278 English cubic feet in the sales effected in 1869-70. The company has now works in operation at Arras, Bergues, Cambral, Catana, Charleroi, Chemnitz, Dunkerque, Fourmies, Herstal, Louvain, Marchienne-au-Pont, Prague, Rimmi, St. Omer, Sienna, Tournal, and Valenciennes-Anzin.—*London Mining Journal.*

Chemical Repertory.--No. 43.

DECEMBER 16, 1870.

Editor—Henry Wurtz.

ON THE DETERMINATION OF THE PHOTOMETRIC POWER OF A RICH GAS BY DILUTION WITH A POOR GAS OF KNOWN VALUE: THE "METHOD OF MIXTURES."

BY B. SILLIMAN.

[From the Am. Jour. of Science and Arts, Vol. L, Nov. 1870.]

In a paper on "Farmer's Theorem,"* I have given several examples of the method of determining the intensity or photometric power of a rich gas by diluting it with several times its own volume of a poorer gas of known intensity, and then calculating its value from the increment of intensity. Having demonstrated in the paper before mentioned the worthlessness of all determinations of the intensity of gases of high illuminating power made by burning them in volumes less than five cubic feet, and then calculating their intensity by the rule of three up to that volume, I have shown how much more exact results were obtained when the results were calculated upon the theorem of Mr. Farmer; this greater exactness being predicated largely upon the confirmation drawn from parallel observations upon the same gases when measured by the method of mixtures. The results thus obtained having, however, been questioned by Mr. Stimpson, † on the ground that the method itself had not been experimentally demonstrated, I have undertaken lately, in connection with Mr. Farmer, to make some experiments calculated to test its accuracy.

The results which go to support the accuracy of the method were obtained with the use of a new photometric apparatus, constructed for the Manhattan Gas Co., under my direction, by Sugg of London, and which was designed to embrace all the best improved features which recent experience has indicated in photometry. A discussion of these details would be out of place in this connection. Before detailing our results, it will be proper to present the method of determination of intensity for gas of high illuminating power as practiced by Mr. Farmer at the Manhattan Gas Works in New York, and which I have called *the method of mixtures.*

To find the candle power of a gas having, for example, an intensity greater than 20 candles, mix the rich gas of unknown power with a poorer gas of known power in such proportions that the intensity of the mixture shall not be greater than 20 candles power, when consumed at the agreed rate of not over five cubic feet per hour. Then to compute the candle power (intensity) of the rich gas,—

Let a=the percentage or volume of gas of low intensity.

Let b=the intensity in candles of the gas of low insity.

Let c=the percentage or volume of rich gas used in the mixture.

Let d=the intensity in candles of the mixture as observed.

Let x=the intensity in candles of the rich gas required.

$$\text{Hence, } \frac{ab \times cx}{a+c}=d \qquad \frac{(d-b)a}{c}+d=x$$

$$ab+cx=ad+cd$$

$$cx=ad+cd+ab.$$

And this expression is stated arithmetically in the following

Rule:—Subtract the intensity of the poor gas from the intensity of the mixture; multiply the remainder by the volume of poor gas; divide the product by the volume of rich gas; add to the quotient the intensity of the mixed gas, and the sum is the intensity of the rich gas sought.

Now when we reflect that in any given illuminating gas we have always a certain volume of non-luminous combustible gas, as the substratum to which is added, according to its source and mode of treatment, a variable volume of illuminants, it is no unwarranted assumption to say that the illuminants (chiefly olefines) are *diluted* by the non-illuminants. It is agreed, on all hands, that hydrogen, marsh gas and carbonic oxyd, which together form the mass of the non-luminous substratum of all illuminating gas, have of themselves, when pure, no luminosity, and when burned at ordinary atmospheric pressures and corresponding temperatures, that they may in fact be called, as to luminosity, neutral. It can hardly be questioned that the intensity which these neutral gases may assume in a given mixture must depend, under the same ordinary conditions before mentioned, upon the amount and kind of olefines they may take up in the destructive distillation of the coal or other hydrocarbons used in making gas. If these assumptions are true, we ought to be able to demonstrate them by experiment, by commingling certain volumes of a gas of known intensity with a neutral gas of no intensity. These experimental conditions would be met by using carbonic oxyd as the neutral gas, or better still, the mixture of carbonic oxyd and hydrogen resulting from the decomposition of vapor of water at a high temperature in contact with highly ignited carbon, as in the hydrocarbon gas process. But in default of any convenient means of obtaining these gases, we had recourse to hydrogen gas evolved by the action of diluted sulphuric acid upon zinc in a large self-regulating generator of hydrogen. It is well known that hydrogen thus made is not absolutely non-luminous, but it is sufficiently so for photometric purposes. The avidity of hydrogen for all the olefines, however, renders it difficult to obtain entirely satisfactory results with the use of this gas, provided it is passed through gas pipes and holders which have been previously used for the transmission of coal gas, since however carefully one may rinse out these tubes by hydrogen, there may yet cling, probably, some small trace of the condensed illuminants to the walls of the tubes, which imparts a trifling intensity to the hydrogen passing through them.

To obtain a supply of rich gas of uniform intensity, 100 lbs. of Albertite was coked until 810 cubic feet of gas had been taken from it of a density of ·498. This gas was purified, collected and preserved in a separate gas holder. Its intensity was determined.

1st.	By Farmer's Theorum	= 30·49 candles.
3d.	" mixing with poor gas	= 30·95 "
3d.	" simple ratio	= 26·20 "

In determining the intensity of this gas by the method of mixtures, 20 per cent by volume of Albert gas was mingled with 80 per cent of 10.6 candle gas obtained from a poor coal. The mixture had an intensity of 14.67 candles. Hence,

$(14.67-10.60) \times 80 \div 20 + 14.67 = 30{\cdot}95$ candles for the intensity of the Albert Gas by the method of mixtures.

1st Experiment.

Taken	75 vols. coal gas	=14·75 candles, obs'd	
"	25 " hydrogen	=	
"	100 " mixture	= 10·22	" "
If hydrogen=0 this mixture should have given		=11·06	" calc.
Hence there is an error of observation of		= ·84 of a candle,	

which makes the value of the hydrogen apparently below zero.

2d Experiment.

Taken	75 vols. coal gas	=14·25 candles. obs'd	
"	25 " hydrogen	=.....	" "
"	100 " mixture	=10·35	" "
If Hydrogen=0 this mixture should have given		=10·69	" calc,
Hence there is an error of observation		= ·25	" which

again makes the value of the hydrogen, apparently a little below zero.

The want of sufficient storage room for hydrogen and the necessity of many repetitions, and much care in manipulation to avoid errors of quantity in the synthesis of mixtures make experiments of this sort tedious, and my other avocations have prevented my multiplying them as much as is desirable. I think, however, that most photometric observers will agree with me that it is safe to conclude, from these two experiments, that the action of hydrogen in gaseous mixtures is simply that of a diluant. We might make a thousand observations by the means now at command, and not obtain one with an exact 0 for hydrogen. A very trifling error in the admeasurement greatly influences the result.

We may therefore safely conclude, as it appears to me—

1st. That in all illuminating gas we have a certain substratum of non-luminous gas, holding in solution a variable volume of luminous gas (olefines).

2d. That when a gas is too rich in illuminants to permit of accurate photometric admeasurements by the usual standards of intensity, it may be diluted with a poor gas of known value and volume to such a standard as is consistent with the accurate employment of the usual photometric apparatus, its true value being then calculated from the known values employed.

P. S. I find in the manuscript records of the Manhattan Gas Company, mention of four experiments made many years since by Mr. Schultz, chemist of that company, in which he mixed 5 per cent. and 10 per cent. of hydrogen with gas of very high illuminating power. The results are less satisfactory than they would have been, had the volume of hydrogen employed been much larger and the intensity of the coal gas not over 15 candles. Moreover at that time the means of admeasurement at the command of the observer in the laboratory of the Manhattan Company of small volumes of gas were much less exact than they now are. The results obtained are as follows:

1st Experiment.

Taken	90 vols coal gas	=22.53 candles, observed.	
"	10 " hydrogen	=	
"	100 " mixture	=19.11	" "
If the hydrogen is taken as 0 mixture		=20.27	" calculated.
Showing apparent error of		=— 1·11	" "

2d Experiment.

Taken	95 vols coal gas	=22·53 candles, observed.	
"	5 " hydrogen	=	
"	100 " mixture	=20·35	" "
If the hydrogen is taken as 0 mixture		=21·39	" calculated.
Apparent error		=— 1·04	" "

3d Experiment.

Taken	90 vols coal gas	=20·83 candles, observed.	
"	10 " hydrogen	=	
"	100 " mixture	=19·44	" "
If hydrogen is taken=0 mixture		=18·29	" calculated.
Apparent error		+ ·15	" "

4th Experiment.

Taken	95 vols coal gas	=20·83 candles, observed.	
"	5 " hydrogen	=	
"	100 " mixture	=20·52	" "
If hydrogen taken =0 mixture		=19·79	" calculated.
Apparent error,		+ ·73	" "

NEW HAVEN, Sept. 1870.

NOTE TO MR. STIMPSON'S PAPER ON FARMER'S THEOREM.

(This paper of Mr. Stimpson will be found in our last issue.)

BY B. SILLIMAN.

[From the Am. Jour. of Science and Arts, Vol. L., Nov. 1870.]

MR. STIMPSON'S criticism on the first experiment of my paper was induced by an obvious numerical error in the statement of the data, which Mr. S. has himself corrected in a foot note on p. 373. The experiment properly stated exactly sustains the theorem.

I admit that in Experiment No. 2, the exponents come nearer to the third power than to the square, being 2.689, 2.638 and 2.669; in the three cases average 2.661. But it also indicates that the illuminating power of the standard 3.30 cubic feet was very imperfect. The experiments, however, appear to me to demonstrate clearly the radical inaccuracy of the old rule for photometric culculations, and that some ratio near to or greater than the square gives more trustworthy results than the old rule.

In Experiment No. 3, the exponents are respectively 2.552, 2.297 and 2.092, coming in the last very near the square. It shows that 4.88 cubic feet consumption gave the best results, and also that 3.72 and 7.219 cubic feet consumption gave very nearly the same degree of intensity of combustion.

In Experiment No. 4, the exponent 1.85 power for a consumption of 9.519, shows an imperfect combustion of the fish-tail burner employed.

In Experiment No. 5, the experimental conditions were wholly unfavorable to accuracy, owing to an inequality of pressure unavoidable in the experimental method adopted, there being one inch pressure on the 10.06 cubic feet consumption, and only half an inch on the 5.16 cubic feet. It is well known to all photometric observers how important a low pressure, also an equal pressure, are to the results obtained. It was hardly fair to Mr. Farmer to have quoted this trial, but I was desirous of exhibiting the entire range of observation, bad as well as good.

As in Experiment No. 6, the consumption of sperm was in the two tests very nearly uniform; the difference would be very trifling if the correction had been applied. Nor is it by any means so certain that Farmer's Theorem applies to the candle, as I supposed when the remarks quoted by Mr. Stimpson were made, since, if a candle burns much over 120 grains it smokes ("tails off"), and then there is an end of all accuracy, and the observation must be rejected; since there is an imperfect combustion, giving an increase in consumption but not in intensity.

Mr. Stimpson rejects all the data given by me which are founded upon the determination of the intensity of a rich gas by the 'method of mixtures,' because, as he says, the accuracy of this method has not yet been demonstrated by experiment. But this objection ceases to have force now that experiments, made by Mr. Farmer and myself lately, prove that this method is wor

* Am. Sci. Jour., II, xlix, 17; also Proceedings of American Association for Advancement of Science, Salem meeting, 1869, p, 149.

† See page 272, this volume of Am. Sci. Jour.

thy of confidence. Insamuch as the most important case for the use of Farmer's Theorem is that of gas too rich to be burned by the standard burner on a basis of 5 cubic feet per hour, it is striking off by all means the most valuable portion of my contribution to photometrical methods if it could be shown that 'the method of mixtures' was untrustworthy. I am, therefore, glad of this occasion to reiterate my confidence in this method, and to refer the reader curious in such matters to a brief paper of mine upon this subject, which will be found on page 379.

I care very little whether the results of experiment shall show, when they are sufficiently accumulated, that the ratio of consumption of gas is to the intensity produced as the squares of consumption in a given case, or in some other ratio greater than a simple ratio. I have desired chiefly to call attention to the general untrustworthiness of all photometric observations which are made with volumes of gas much less than the normal standard adopted, when these results are calculated on the simple ratio of the consumptions. It is only by the the accumulation of carefully conducted experimental data that a law can be established, and these data are now pretty rapidly accumulating.*

* In the proceedings of the American Association for Advancement of Science, Salem meeting, I presented the matter, referring to *Sugg's Manipulation* in a different form, giving the results of the observations with his Argand burner in a tabular form as follows:

No. obs.....	Cubic feet...	Observations corrected by old rule candles.....	Differences...	Unconverted observations.....	Observations corrected by Farmer's Theorem...	Differences...
1.	5·	14·00		14·00	14·00	
2.	4·9	13·78	0·22	13·504	14·060	0·556
3.	4·8	13·74	0·26	13·190	14·312	1·122
4.	4·7	13·30	0·70	12·502	14·148	1·646
5.	4·6	13·04	0·96	11·996	14·191	2·105
6.	4·5	11·93	2·07	10·738	13·255	2·517

The mean candle power of the 6th column is 13.99 candles; difference 0.01 candle.

The following will show the fractional power required to bring the uncorrected cobservations (column 5) to 14.00 candles.

2.	$4{\cdot}9^{1{\cdot}83}$: 13·504	: :	$5^{1{\cdot}83}$: 14·00	candles.
3.	$4{\cdot}8^{1{\cdot}47}$: 13· 90	: :	$5^{1{\cdot}47}$: 14·00	"
4.	$4{\cdot}7^{1{\cdot}85}$: 12·502	: :	$5^{1{\cdot}85}$: 14·00	"
5.	$4{\cdot}6^{1{\cdot}86}$: 11·996	: :	$5^{1{\cdot}86}$: 14·00	"
6.	$4{\cdot}5^{2{\cdot}52}$: 10·737	: :	$5^{2{\cdot}52}$: 14·00	"

This table shows that the 3rd and 6th tests have not been been good ones, while the 2d, 3d, 4th and 5th tests fall a little below the square or 2d power, and the 6th test is considerably more.

New Haven, July, 1870.

Practical Management of Gas Works.

By James R. Smedberg.

[Written Expressly for this Journal.]

Number XIII.

My purpose in departing from the regular order of these articles is to elicit an interchange of opinion regarding a subject which is nowhere treated in the books, and which is of prime importance to every engineer who contemplates the construction or enlargement of station works. My attention has been specially directed to it by Mr Farmer's article on the subject, and by the adoption of 16-inch pipes for a make of 1,000,000 per day by my friend Mr Edge, of the Jersey City Gas Works. I must confess that the diameter adopted by the latter engineer seemed entirely too small: but an examination of Barlow's tables now satisfies me that his construction is as close as possible to absolute correctness, or, in other words, that he has selected the minimum diameter which affords sufficient capacity of discharge.

In an investigation made solely for my own purposes, and without consultation, I decided to represent the obstruction dne to bends, length of conduit, and irregular passage by some simpler expression than is usual, and finally assumed the volume as that discharged through 1500 feet of each size of pipe, with a loss of two-tenths pressure. With this pressure, we take from Clegg the following sizes of pipes for works of different capacities.

Size of station connections, deduced from quantities delivered through 1500 feet of pipe with 2-10 inch loss of pressure.

Size of connections.	Cubic feet per day.	
4-inch	33,000	cubic feet.
6-inch	90,000	" "
8-inch	186,000	" "
10-inch	324,000	" "
12-inch	514,000	" "
16-inch	1,049,000	" "
18-inch	1,411,000	" "
20-inch	1,836,000	" "
24-inch	* 2,856,000	" "

The size of the purifiers must vary with the quality of the lime used and of the coal carbonizd. While the boxes may be constructed to receive seven tiers of trays, my own preference is to use only six, and as the stone lime of California purifies about 2,250 cubic feet, per bushel of hydrate, of the gas from our usual mixture of coals, the size of purifiers for this coast is thus determined, the lime being spread 2 inches thick on the trays.

One bushel of hydrate covers 7½ square feet of trays and purifies 2250 cubic feet of gas, being in proportion of 3⅓ square feet of trays per 1,000 cubic feet. The total purifying surface in each box, then, is $\frac{10\ Q}{3}$ Q being the quantity of gas to be purified in 24 hours, in thousands of cubic feet, if 6 trays be used, and square purifiers; the side of the box is represented by the expression $\sqrt{\frac{10\ Q}{3\times 6}} = \sqrt{\frac{5\ Q}{9}}$, or to express it otherwise: The square root of five-ninths the quantity per day, in thousands of cubic feet represents the side of the square purifier of six trays.

Thus, to purify 1,000,000 per day, we have for the size of the purifier $\sqrt{\frac{5\times 1000}{9}} = 23.56$ feet—say 24 feet square.

And the following becomes the completed;

Diameter of constructions.	Side of Square Purifiers.	Capacity of Work per day.
4-inch	4 ft. 3 in.	33,000
6-inch	7 " 1 "	90,000
8-inch	10 " 2 "	186,000
10-inch	13 " 5 "	324,000
12-inch	16 "10 "	514,000
16-inch	24 " 2 "	1,049,000
18-inch	28 " 0 "	1,411,000
20-inch	31 "11 "	1,836,000
24-inch	39 "10 "	2,856,000

The mean velocity of the gas through the boxes is 1¼ feet per minute.

Newbigging proposes to make the diameter of the connections equal in inches to the length of the purifier in feet: Farmer proposes the constant .8 as a multiplier of the length of the side. I will first show the effect of these constants, 1. and .8, in a comparative table, and afterward explain why the proportion must vary for each size of pipe:

Side of sq. Purifier.	Connections. Diameter inches.			Diameter in ins. for 1 foot length of side.		
	Newbigging.	Farmer.	Smedberg.	Newbigging.	Farmer.	Smedberg.
4ft. 3in.	4.25	3.40	4.	1.00	.80	.94
7ft. 1in.	7.08	5.67	6.	1.00	.80	.84
10ft. 2in.	10.17	8.13	8.	1.00	.80	.79
13ft. 5in.	13.42	10.73	10.	1.00	.80	.75
16ft. 10in.	16.83	13.46	12.	1.00	.80	.71
24ft. 2in.	24.16	19.33	16.	1.00	.80	.66
28ft. 0in.	28.0	22.40	18.	1.00	.80	.64
31ft. 11in.	31.92	25.53	20.	1.00	.80	.63
39ft. 10in.	39.83	31.87	24.	1.00	.80	.60

The diameter of the constructions cannot bear a constant relation to the square root of the area of the purifier, because the friction is not inversely as the square of the diameter of the conduit, but diminishes much faster than the square of the diameter increases. Thus the deliverv of a 24 inch pipe is 87 times that of a four inch pipe instead of 36 times, which is the ratio of the squares of the two diameters.

According to Arson's formulas the increase in power of large pipes would be yet more rapid; but I am inclined to follow Pole in distrusting the deductions from the experiments at La Villette.

From all this, I would, in construction, be governed as to the size of connections by the first table, and decide the size of the purifiers by the local facts of coal and lime.

I would here propose an arrangement of large purifiers which will very much lessen the labar of working them, and the area occupied by the building which contains them. The purifiers are, suppose, 25 feet square, and are to be elevated ten feet above the ground, over an an airy and well lighted basement. The hydrate of lime is to be brought directly into the boxes, there being two lines of track across each box, connecting by turn-tables with lateral rails along the side of the house; the cups being crossed by short pieces of rail which may be removed or swung back on hinges when the cover is down. The purifiers are placed only two feet apart, and each purifier is discharged through two 24-inch square openings in the bottom, provided with water-lutes which receive sheet-iron covers previous to placing the box in action.

The spent lime is to be removed from the basement by carts. The dry center valve, is placed at the side of the building, as in the 18th street station of the Manhattan, and a smaller rotatiug valve serves to couple the deodorizing exhauster with either of the purifier inlets at will. After the cover is down, it is prevented from vibration by a stout serew which passes through its center and enters a stationary nut strapped across the outlet.

Each cover is to be nearly counterbalanced by a wire rope suspension led home to a single weight, and the slight duty of lifting is performed by a hydraulic hoist. The counterbalance weights are to be in the cellar, and are *not* to hang over the covers, as I once saw them years ago, in one of our principal works.

The outlet pipe must be covered by a light lid while the deodorizing exhaust is at work, as other wise the down-flowing air would pass freely to the exhauster through the center-valve, instead of traversing the layers of foul lime. Mann's device of desulphurating the foul air by oxide of iron should always be adopted.

A release-valve is given in Schilling's book on Coal Gas, or some form of the Chapman Valve may be used.

Having explained my objection to admitting any constant relation between the side of the purifier and the diameter of connections, I proceed to quote the following very valuable observations from Mr. Farmer's article, published in the Gas-Light Journal of September 2nd:

"For small gas works that are intended to be run without an exhauster at first, it will be better to calculate the purifiers for five tiers, and the lime on each only one inch thick, so as to reduce the back pressure on retorts as much as possible; and then, by and by, when the work increases, and an exhauster is required, the thickness of lime on trays may be raised to two inches, and thus increase the working capacity of the purifier.

"In determining the size of purifiers, especially for some stone limes, it is of the greatest importance to give them ample area.

"A set, consisting of only two boxes is a very extravagant method of purifying gas, as the purifying property of the lime is far from being exhausted when the purifiers have to be taken up, and the lime thrown away.

"For instance, if the first purifier stains at 8,000 cubic feet, the second purifier will stain at about 24,000 cubic feet, if the first box. after it has stained, could be left on to work with it A set consisting four purifiers will be found to give the best results. * * * *

"For large works, the cups for seals should not be less than 16 inches deep and 3 inches wide; and the tank for a wet center seal should be 32 inches deep, or just twice the depth of cup on the purifiers.

"For small works with one or two light holders, 12 inches may do for the depth of cups, and 24 inches for the depth of tank for wet center seal."

Circular purifiers, such as are adopted at the great works of the Chartered, at Beckton, have the advantages of affording less vertical surface for the gas to cling to, and of costing rather less to construct, but the trays are of several different shapes, and they do not economize room in a building as thoroughly as square ones.

What Mr. Farmer says of the inconvenience of purifiers more than 25 feet square is undoubtedly true, unless the plan of discharge through the bottom be adopted; but I should have little hesitation in constructing boxes 40 feet square if required to do so, and if a basement story were possible.

In works where the wet center seal is used, a duplicate drum or cover should always be at hand. The test jets of the purifiers may show clean, and yet the gas be passing foul through the center seal, by reason of corrosion of the radical partitions; and I suspect other managers, as well as myself, have been puzzled by this occurrence while passing through their novitiate.

One objection to the wet seal—the large space it occupies might be lessened by sealing the cover in circular and radial water spaces 2-inches wide, leaving the sub-triangutar areas between them for gas-ways.

I am satisfied, however, that the surface-covers recently applied to the dry seal renders it a far more compact and elegant device, and frees it from all practical objection.

I find that caustic ammonia will completely purify coal gas from sulphur; but the action of my experimental scrubber has been too uncertain to warrant a publication of the results. Some cause, as yet undiscovered, occasionally interrupts the absorption of the sulphur, and certain English engineers are equally certain as to the fact, and uncertain as to the cause. The superior elegance, simplicity, and economy of liquid purification will before long, however, probably evoke from the ingenuity of our engineers some apparatus perfectly adapted to it.

Messrs. Editors: At Mr. J. R. Smedberg's request, I have carefully read his valuable paper on "Connect-

ing Pipes and Purifiers," before handing it over to you for publication.

I agree with him, that it will be much better to take the volume of the gas to be purified, for the basis, instead of the side of purifier, for determining the sizes of connecting pipes to purifiers.

But when the volume of gas is too large to be passed through one set of purifiers twenty-five feet square, I still think it will be better to divide them up into two or more sets.

Perhaps I may prepare another paper on this subject for your next number. WM. FARMER.

The Chemical History of a Candle.

BY PROFESSOR FARADAY,

[A Course of Six Lectures delivered before the Royal Institution of Great Britain.]

LECTURE V.

Oxygen Present in the Air—Nature of the Atmosphere—Its Properties—Other Products from the Candle—Carbolic Acid—Its Properties.

[Continued from page 164.[

Here is something that you can have a pull at when I have finished here to-day. It is a little apparatus of two hollow brass hemispheres closely fitted together, and having connected with it a pipe and a cock, through which we can exhaust the air from the inside, and though the two halves are so easily taken apart while the air is left within, yet you will see when we exhaust it by and by, no power of any two of you will be able to pull them apart. Every square inch of surface that is contained in the area of that vessel sustains fifteen pounds by weight, or nearly so, when the air is taken out; and you may try your strength presently in seeing whether you can overcome that pressure of the atmosphere.

Here is another very pretty thing—the boy's sucker, only refined by the philosopher. We young ones have a perfect right to take toys, and make them into philosophy, inasmuch as now-a-days we are turning philosophy into toys. Here is a sucker, only it is made of India-rubber; if I clap it up on the table, you see at once it holds. Why does it hold? I can slip it about, but if I try to pull it up, it seems as if it would pull the table with it. I can easily make it slip about from place to place; but only when I bring it to the edge of the table can I get it off. It is only kept down by the pressure of the atmosphere above. Here is a couple of them; if you take these two and press them together, you will see how strong they stick. And, indeed, we may use them as they are proposed to be used, to stick against windows or against walls, where they will adhere for an evening, and serve to hang anything on that you want. I think, however, that you boys ought to have experiments that you can make at home; and so here is a very pretty experiment in illustration of the pressure of the atmosphere. Here is a tumbler of water; suppose I were to propose to you to turn that tumbler upside down, so that the water should not fall out, and yet not keep it in by my hand, but merely by using the pressure of the atmosphere; could you do that? Take a wine glass, either quite full or half full of water, and put a flat card on the top; turn it upside down, and then see what becomes of the card and of the water. The air cannot get in because the water, by its capillary attraction round the edge, keeps it out.

I think this will give you a strong notion of what you may call the materiality of the air, when I tell you that that box contains a pound of it, and this room more than a tun, and you will begin to think that air is something very serious. I will make another experiment to convince you of this positive resistance. There is that beautiful experiment of the pop gun, made so well and so easily, you know, out of a quill, or a tube, or anything of that kind; where we take a slice of potato, for instance, or an apple, and take the tube and cut out a pellet, as I have now done, and push it to one end. I have made that tight; and now I take another piece and put it in; it will confine the air that is within the tube perfectly and completely for our purpose; and now I shall find it absolutely impossible, by any force of mine, to drive that little pellet close up to the other. It cannot be done; I may press the air to a certain amount, but if I go on pressing, long before it come to the second, the confined air will drive the front one out with a force something like that of gunpowder; for gunpowder is in part dependent upon the same action that you saw in this case.

Here is an experiment which I saw the other day, and was much pleased with it, as I thought it would answer our purpose here. (I ought to have held my tongue for four or five minutes before I began this experiment, because I depend upon the strength of my lungs for the success of it.) By the proper application of air, I expect to drive this egg out of one cup into the other by the force of my breath, but if I fail, it is in a good cause, and I do not promise success, because I have been talking more than I ought to do, to make the experiment succeed.

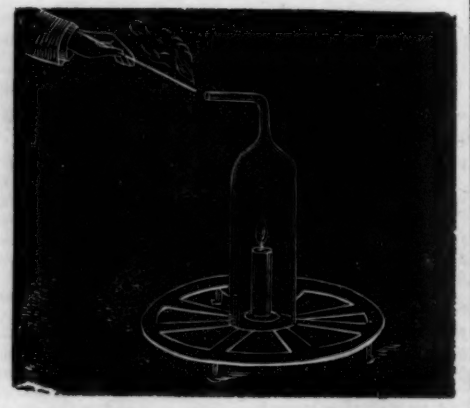
[The lecturer here tried the experiment, and succeeded in blowing the egg from one egg-cup to the other.]

You see that the air which I blow goes downward between the egg and the cup, and makes a blast under the egg, and is thus able to lift a heavy thing—for a full egg is a very heavy thing for air to lift. If you want to make the experiment, you had better boil the egg quite hard first, and then you may very safely try to blow it from one cup to the other with a little care.

I think I have now kept you long enough upon this property of the weight of the air, but there is another thing I should like to mention. You saw the way in which, in this pop-gun, I was able to drive the second piece of potato half or two-thirds of an inch before the first piece started, by virtue of the elasticity of the air; just as I pressed into the copper bottle the particles of air by means of the pump. Now, this depends upon a wonderful property in the air, namely, its elasticity, and I should like to give you a good illustration of this. It is this: if I take anything that confines the air properly, as this membrane, it is able to contract and expand so as to give us a measure of the elasticity of the air, and to confine with a certain portion of air; and then, if we take the atmosphere off from the outside of it, just as in these cases we put the pressure on—if we take the pressure off, you will see how it will then go on expanding and expanding, larger and larger, until it will fill the whole of this bell jar, showing you that wonderful property of the air, its elasticity, its compressibility and expansibility to an exceedingly large extent: and this is very essential for the purposes and services it performs in the economy of creation.

We will now turn to another most important part of our subject, remembering that we have examined the candle in its burning, and have found that it gives rise to various products. We have the products, you know, of soot, of water, and of something else which you have not examined. We have collected the water, but have allowed the other things to go into the air. Let us now examine some of these other products.

Here is an experiment which, I think, will help you in part in this way. We will now put our candle there, and place over it a chimney, thus. I think my candle will go on burning, because the air passage is open at



the bottom and at the top. In the first place, you see the moisture coming—that you know about. It is water produced from the candle by the action of the air upon its hydrogen. But besides that, something is going out at the top; it is not moisture—it is not water—it is not condensible; and yet, after all, it has very singular properties. You will find that the air coming out of the top of our chimny is nearly sufficient to blow the light out I am holding to it, and if I put the light fairly opposed to the surrent, it will blow it quite out. You will say, that is as it should be, and I am supposing that you think it ought to do so, because the nitrogen does not support combustion, and ought to put the candle out, since the candle will not burn in nitrogen. But is there nothing else there than nitrogen? I must now anticipate—that is to say I must use my own knowledge, to supply you with the means that we adopt for the purpose of ascertaining these things, and examining such gases as these. I will take an empty bottle—here is one—and if I hold it over this chimney, I shall get the combustion of the candle below, sending its results into the bottle above; and we shall soon find that this bottle contains, not merely an air that is bad as regards the combustion of a taper put into it, but having other properties.

Let me take a little quick-lime and pour some common water on to it—the commonest water will do. I will stir it a moment, then pour it upon a piece of filtering paper in a funnel, and we shall very quickly have a clear water proceeding to the bottle below, as I have here. I have plenty of this water in another bottle, but, nevertheless, I should like to use the lime water that was prepared before you, so that you may see what its uses are. If I take some of this beautiful clear lime water, and put that into this jar, which has collected the air from the candle, you will see a change coming about. Do you see that that water has got quite milky? Observe, that will not happen with air merely, Here is a bottle filled with air, and if I put a little lime water into it, neither the oxygen nor the nitrogen, nor anything else that is in that quantity of air, will make any change in the lime water—it remains clear and perfect, and no shaking of that quantity of lime water with that quantity of air in its common state will cause any change; but if I take this bottle with the lime water and hold it so as to get the general products of the candle in contact with it, in a very short time, you see, we shall have it milky,—there is the chalk, consisting of the lime which we used in making the lime water, combined with something that came up from the candle—that other product which we are in search of, and which I want to tell you about to-day. This is a substance made visible to us by its action, which is not the action of the lime water itself, but it is something new to us from the candle. And then we find this white powder produced by the lime water and the vapor from the candle, appears to us very much like whiting or chalk, and when examined it does not prove to be exactly the same substance as whiting or chalk. So we are led, or have been led, to observe upon the various circumstances of this experiment, and to trace this production of chalk to its various causes to give us the true knowledge of the nature of this combustion of the candle—to find that this substance issuing from the candle is exactly the same as that substance which would issue from a retort if I were to put some chalk into it and make it red hot with a little moisture; you would then find that exactly the same substance issue from it as from a candle.

But we have a better means of getting this substance, and in greater quantity so as to ascertain what its general characters are. We find this substance in very great abundance in a multitude of cases where you would least expect it. All limestones contain a great deal of this gas which issues from the candle, and which we call *carbonic acid*. All chalks, all shells, all corals, contain a great quantity of this curious air. We find it fixed in these stones, for which reason Dr. Black called it "fixed air"—finding in these fixed things like marble and chalk—he called it fixed air because it lost its quality of air, and assumed the condition of a solid body. We can easily get this air from marble. Here is a jar containing a little muriatic acid, and here is a taper which, if I put it to that jar, will show only the presence of common air. There is, you see, pure air down to the bottom; the jar is full of it. Here is a substance—marble, a very beautiful and superior marble—and if I put these pieces of marble into that jar, a great boiling apparently goes on. That, however, is not steam; it is a gas that is rising up, and if I now search the jar by a candle, I shall have exactly the same effect produced upon the taper as I had from the air which issued from the end of the chimney over the burning candle. It is exactly the same action, and caused by the very same substance that issued from the candle; and in this way we can get carbonic acid in great abundance—we have already nearly filled the jar. We also find that this gas is not merely contained in marble. Here is a vessel in which I have put some common whiting chalk, which has been washed in water, and deprived of its coarser particles, and so supplied to the plasterer as whiting. Here is a large jar containing this whiting and water, and I have here some sulphuric acid, which is the acid you might have to use if you were to make these experiments (only in using this acid with limestone, the body that is produced is an insoluble substance, whereas the muriatic acid produces a soluble substance that does not much thicken the water). And you will seek out a reason why I take this kind of apparatus for the purpose of showing this experiment. I do it because you may repeat in a small way what I am about to do in a large one. You will have just the same kind of action, and I am evolving in this large jar carbonic acid exactly the same in its nature and properties as the gas which we obtained from the combustion of the candle in the atmosphere. And no matter how different the two methods by which we prepare this carbonic acid, vou will see, when we get to the end of our subject, that it is all exactly the same, whether prepared in the one way or in the other.

We will now proceed to the next of our experiments with respect to this gas. What is its nature? Here is one of the vessels full, and we will try it as we have done so many other gases—by combustion. You see it is not combustible, nor does it support combustion. Neither, as we know, does it dissolve much in water, because we collect it over water very easily. Then you know that it has an effect and becomes white in contact with lime water, and when it does become white

in that way, it becomes one of the constituents to make carbonate of lime or limestone.

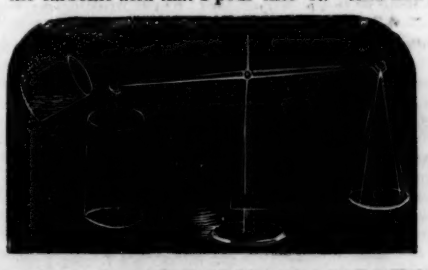
Now, the next thing is to show you that it does dissolve a little in water, and therefore that it is unlike oxygen and hydrogen in that respect. I have here an apparatus by which we can produce this solution. In the lower part of this apparatus is marble and acid, and in the upper part cold water. The valves are so arranged that the gas can get from one to the other. I will set in action now, and you see the gas bubbling up through the water, as it has been doing all night long, and by this time we shall find that we have this substance dissolved in the water. If I take a glass and draw off some of the water I find that it tastes a little acid to the mouth; it is impregnated with carbonic acid; and if I now apply a little lime water to it, that give us a test of its presence. This water will make the lime water turbid and white, which is the carbonic acid test.

Then it is a very weighty gas; it is heavier than the atmosphere. I have put their respective weights at the lower part of this table, along with, for comparison, the weights of the other gases we have been examining:

	PINT.	CUBIC FOOT.
Hydrogen.....	¾ grs.	1.12 oz.
Oxygen.....	11 9.10	1 1.3
Nitrogen.....	10 4.10	1 1.6
Air.....	10 7.10	1 1.5
Carbonic Acid.....	16 1.3	1 9.10

A pint of it weighs 16 1-3 grains, and a cubic foot weighs 1 9-10 ounces, almost two ounces. You can see by many experiments that this is a heavy gas. Suppose I take a glass containing nothing else but air, and this vessel containing the carbonic acid; and suppose I pour a little of this gas into that glass, I wonder whether any has gone in or not; I cannot tell by the appearance, but I can in this way [introduces the taper]. Yes, there it is, you see; and if I were to examine it by lime water I should find it in the same way. I will take this little bucket, and put it down into the well or carbonic acid—indeed we too often have real wells of carbonic acid—and now, if there is any carbonic acid I must have got to it by this time, and it will be in this bucket, which we will examine with a taper. Lhere it is, you see; it is full of carbonic acid.

I have anofher experiment by which I will show you its weight. I have here a jar suspended at one end of a balance—it is now equipoised, but when I pour this carbonic acid into the jar on the one side, which now contains air, you will see it sink down at once, because of the carbonic acid that I pour into it. And now I



examine this jar with the lighted taper. I will find that the carbonic acid has fallen into it, and it no longer has any power of supporting combustion. If I blow a soap bubble, which, of course, will be filled with air, and let it fall into this jar of carbonic acid, it will float. But I shall, first of all, take one of these little balloons filled with air. I am not exactly sure where the carbonic acid is; we will just try the depth, and see whereabouts is its level. There, you see, we have this bladder floating on the carbonic acid, and if I evolve some more of the carbonic acid, you will see the bladder lifted up higher. There it goes; the jar is nearly full, and now I will see whether I can blow a soap bubble on that and float it in the same way.

[The lecturer here blew a soap bubble, and allowed it to fall into the jar of carbonic acid, when it floated in it midway.] It is floating as the balloon floated, by virtue of the greater weight of the carbonic acid than of the air. And now, having so far given you the history of the carbonic acid, as to its sources in the candle, as to its physical droperties and weight, when we next meet I shall show of what it is composed, and where it gets its elements from.

THE sales of gas effected by the Belgian General Company for lighting and heating by gas in the nine months ending May, 1870, inclusive, amounted to 296,521,484 English cubic feet, against 278,298,206 English cubic feet in the corresponding months of 1868-9. There was thus an augmentation of 18,223,278 English cubic feet in the sales effected in 1869-70. The company has now works in operation at Arras, Bergues, Cambrai, Catana, Charleroi, Chemnitz, Dunkerque, Fourmies, Herstal, Louvain, Marchienne-au-Pont, Prague, Rimini, St. Omer, Sienna, Tournai, and Valenciennes-Anzin.—*London Mining Journal.*

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessary for publication, but as a guarantee of good faith.—EDS.

Peat as a Gas Producing Fuel.

Messrs. Editors: It is observable that your columns have repeatedly furnished, not only items of interest, but carefully written articles bearing upon this subject of *peat*, and that you have ever asserted the importance of encouraging the manufacture and use of it. It is gratifying to know that the matter is at present attracting a great deal of attention, and though the general interest manifested, appears very naturally to turn in the direction of its economy and value for use for heating purposes alone, a few facts will make it apparent that its relations to the gas interest are worthy of consideration.

That it possesses a value for this special purpose has long been known, and to a limited extent it has been used; and although it would be difficult to give a reason why it has not been largely applied, it may reasonably be anticipated, now that peat is likely to come into much more general use for fuel, that its value for gas will be the more readily discerned, acknowledged, and made available in practice. It is a noticeable fact that some of the very earliest experiments in the production of illuminating gas were made upon peat.

It is not known that peat is at present in actual use for this purpose in any part of this country, and although numerous experiments have been made for the purpose of testing its value for the production of illuminating gas, it has been impossible, except in a few cases, to obtain accurate results, in form for publication, though a few instances may indicate the variety in which they might be reported.

The opinion is freely expressed by those who have given it most attention, that it is destined at no distant day, to be very extensively used, both on account of the quality and quantity of gas produced and the low cost of the material as compared with the coals at present most in use.

Among those who have reported upon the matter both in this country and in Europe, a wide difference of opinion appears to exist as to the matter of purifying peat gas; some claiming that it is purified more easily and at much less cost than coal gas, and in some instances, that it required no purification, while others have encountered difficulties which, for the time, seemed to offer serious hindrance to its use.

This is readily accounted for from the simple act that peats differ as much as coals, and the variety of results obtained and opinions expressed and entertained are doubtless chargeable in great measure, to the varying character of the peats experimented upon in different localities. Most peats are comparatively free from acid, while some are strongly charged, requiring, therefore, for the process of purification of the gas, the use of neutralizing materials of strength and properties proportionate.

As in the case of coal, the quality and illuminating power of the gas will probably be affected, not only by the peculiar properties of the peat, but by the degree of heat employed in its preparation and the mode in which the operation is conducted. The experience had goes to show that the charges of peat placed in the retorts should be smaller in bulk, and that they are much more quickly run than is the case with coal

Prof. Johnson of Yale College, who I think, has before been quoted in your columns, on this subject, says "a retort of two feet width, one foot depth, and eight or nine feet length, must receive but 100 lbs. of peat at a charge. The quantity of gas yielded in a given time is much greater than from bituminous coal. From retorts of the size just named, 8,000 to 9,000 cubic feet of gas are delivered in 24 hours. The exit pipes must, therefore, be large, not less than five to six inches, and the coolers must be much more effective than is needful for coal gas, in order to separate it from the tarry matters. The number of retorts requisite to furnish a given volume of gas, is much less than in the manufacture from coal. On the other hand the dimension of the furnace are considerably greater, because the consumption of fuel must be more rapid, in order to supply the heat which is carried off by the copious formation of gas."

Prof. Emmons of New, York who has written most earnestly and at considerable length, on the subject of peat, states that it furnishes an abundance of carburetted hydrogen, equal in illumihating power to oil or gas, and is suitable for gas-light purposes. He closes with the following remark: "We have, therefore, in this homely substance of *peat*, an *invaluable article* of which prejudice alone can prevent a general use."

It is quite probable that a perfected system or process for gas making, adapted to the peculiarities of peat, would show results of which, with only onr present imperfect knowldege of it we have no appreciation.

The following is illustrative of the *volme* of gas produced. At Gas Works in New York city an experiment was made with equal quantities of Cannel coal and peat. The yield of gas 14.376 cubic feet per ton, of twelve candle power. The peat used was of no more than ordinary quality.

The following indicates high *quality* as well as *volume:* Dr. A. A. Hayes of Boston, reports an experiment with 16 lbs. of peat from Wisconsin. The quantity being so small the charge was made up with Pictou coal. 134 lbs. Pictou coal alone, yielded 536 cubic feet of gas: 5 feet being equal to 17 candles, or the whole to 1778 candles. The same quantity (134 lbs) of Pictou coal with the 16 lbs. of peat added, yielded 620 cubic feet of gas: 5 feet of which were equal to 29 4-10th. candles. In his report he says "There are only two or three cannel coals known which afford so much illuminating material, placing this peat in the first class of gas materials. It exceeds all common cannel coals, and of course is far above any bituminous coal, and can be worked with *poor coal* to make *good gas.*"

The coke remaining, as it comes from the retorts is an excellent fuel, rated in value equal to charcoal. In illustration of this, proposals have recently been made to a gas company to supply them with peat for generating gas, free of charge, on the simple condition that the coke remaining should be returned, the producer having ready sale for it a price which, in the aggregate, would yield him more than he would charge the gas company for the peat.

Possibly this single item may be worthy the consideration of some of our large gas companies. These notes are perhaps sufficient to indicate, at least, the probability of a practical value, for gas producing purposes, in the article of *peat;* and should invite energetic research, with a view to develop more perfectiy the requisite process and appliances for producing and purifying the gas.

In another letter I will give brief data concerning this matter in Europe; following that with another relating more particularly to the heating properties of peat gas, as applicable to metallurgic purposes; and perhaps at a subsequent time offer some remarks on the general subject of the composition, properties, method of preparation, and uses of peat as an article of fuel. Very respectfully,

T. H. LEAVITT.

Boston, Dec. 1870.

A Scientific Puzzle.

FIRENZE, November 28th, 1870.

Messrs. Editors: I have lately witnessed a fact, which at first presented itself to me under the appearance of an inexplicable puzzle. I had an ordinary water manometer, to be connected with the town pressure, and fixed to the wall of my room. At first the manometer worked very well, but one day that I had shut the cock, I found the water was slowly coming down, and after a few hours it had reached the same level in both columns. I was not surprised at that, as I could account for it by supposing there was a leak somewhere.

Now the puzzle is *the cock being always shut* the pressure in the manometer came down below zero, as does the pressure before an exhauster, when the exhauster is made to run too fast. The aspiration rose slowly to an inch, and in the main the manometer was connected with, there was always more than an inch pressure. Now how will you account for the aspiration. Of course vacuum was made. For my part I suppose the hydrogen of the gas made its way out of the manometer together with the light fluids, in virtue of that force which is called exosmose. I never had witnessed such a fact before, or either heard of it.

I suppose the passage of the escaping gas was through the screwed part, for after repeating the experiment four times, I unscrewed the manometer for examination, but when it was screwed again I could not repeat the experiment a second time. I suppose it was no more in the same circumstances as before with regard to the screwed part. If any gas man has been called to witness such a feat as the one above suggested, I would feel indebted to know his mind about it. Truly yours,

A. DE LACHOMETTE,
Engineer at the gas works, Florence.

The New York Society of Practical Engineering.

This society held the first meeting of its third annual session, on Wednesday evening Dec. 7th, in the Cooper Union. The President James A. Whitney in the chair.

The regular paper on "Submarine Torpedoes" was read by Mr. Robt. Weir of New York city, formerly of the United States Navy. We present as follows an abstract of its salient points:

The torpedo, which is in fact a submarine rocket, is composed of a thin metal shell made up of two parts, the exploder or torpedo, and the propeller or rocket shaft. The head of the torpedo is made like an ordinary elongated rifle shell, to contain from 100 to 300 lbs. of powder; it is exploded by contact through a percussion cap, which covers the apex of the shell. The rocket or shaft cohtains a composition or rocket powder, which in burning evolves gas very rapidly. The pressure of this gas is used in propelling the torpedo, which is designed to be fired from a gun or guide placed in the vessels side or bows, or in floating batteries, eight or ten feet below the surface of the water. The mode of firing is very simple. The outward valve of the gun being closed, the torpedo is carefully placed in the gun to a marked distance—a wooden salot with a hole in the centre of it is then placed against the rear end, and keels or wings of the torpedo; this is made water tight, fitting snugly in the gun and on the small projecting tube of the torpedo. An inner or breech valve is then clued leaving a space of several inches between the sabot and valve; the outward valve being now opened the water is admitted around the torpedo to the sabot. The rocket powder in the shaft can now be ignited by a friction primer or percussion cap, as in ordinary use for such purposes. The gasses generated by the fire fill the chamber, and the pressure acting against the sabot will drive it with the torpedo from the gun; it is then freed by coming in contact with the water at rest, and the torpedo continues on its course until it strikes and is exploded, or until the propelling power is exhausted. Mr. Wier also stated that from experiments which had been tried with these projectiles on a small scale, the principle was successfully demonstrated, and he believes these torpedoes could be used on a large scale to great purpose. The experimental torpedoes were made about four inches in diameter and thirty inches in length, and driven by one and two pound rockets; the results were so satisfactory, that the inventor believes they can be applied even more satisfactorily on a large scale. He says a torpedo made of one-fourth inch boiler iron, twenty-four inches in diameter, and twelve feet long, with the form which he proposes, would have a displacement of nearly twenty cubic feet; the shell of the machine weighing about 600 lbs., would allow 350 lbs. of powder for the exploder and 300 lbs. for the propelling force. An interesting discussion followed the reading of the paper, during which several plans of operating and igniting fixed torpedoes for harbor defense were briefly touched upon.

Brooklyn Water Supply.

REPORT IN FAVOR OF MAKING THE WORKS SELF SUTSAINING.

At a meeting of the Brooklyn Water Board, Commissioner Fowler presented a communication in reference to the subject of making the Water Department self-sustaining, instead of a tax as at present. The receipts on water revenue accounts, it appears, from the opening of the works, the running expenses, interest, &c., up to December 31, 1870, are as follows:

Total receipts from 1859 to Dec. 31, 1870	$4,916,370 88
Amount levied for deficiencies	695,800 00
	$5,612,170 88
Running expenses from 1859 to Dec. 31, 1870	$1,825,712 10
Interest on bonds	3,898,920 00
	$5,725,632 10
Deducting amount of receipts and moneys levied for deficiencies	$5,612,170 88
Total deficiecy for 1870	$113,461 22

It thus appears that the ordinary expenses and interest account for the year 1870 shows a deficiency of $113,461 22 in the water revenue—not meeting the running expenses and interest on water debt combined.

The cause of the great excess of expenditures over receipts is stated to be that the water rates remain at the price originally fixed, while material, labor and everything else has advanced. New pumping-engines, boilers, coal sheds, etc., have also been constructed, together with the laying of a 48-inch water main six miles long, and a rising main at the reservoir to accomodate the increasing demand for water.

These improvements have cost about $1,700,000. They do not bring in any revenue, and yet bring their proportion of interest (about $100,000 each year) to be provided for. To this may be added extrardinary expenses for repairs, broken pumps, cylinder head, raising and shifting water pipes to conform with altered grades, etc. These expenses have all conspired against the efforts of the Board to make the revenue keep pace with the expense of the department and the interest on the Water Board.

Mr. Fowler suggests as a remedy, the exercise of rigid economy in the administration of the affairs of the department, and an adequate advance of water rates. Taking the past years as a basis, it will be necessary to make an increase in all the rates, which will add to the income of the department as follows:

30 per cent. on building rates	$100,000
20 per cent. on vacant lots	12,000
On bars (low estimate)	5,000
Water-closets, taxing each closet $2	6,000
Street washers, $3 each	4,588
Baths, taxing each bath	1,000
Tax on stationary water tubs	5,000
Stationary was by hand basins	3,000
	$136,588

The report sets forth, in conclusion, that this increase will make the Department self-sustaining, while it will entail no additional tax upon the city, and that it has long been called for as a measure of necessity. The matter was referred to theFinance Committee for consideration and report.

Smedberg's Synopsis.

The following additional subscribers to the above work is herewith acknowledged, making 248:

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RECENT AMERICAN PATENTS.

Pertaining to the Specialties of this Journal, for the two weeks ending December 10th, 1870.

109,371.—Hydraulic Stop Valve.—C. S. Bailey, Mobile, Ala. Antedated Nov. 19, 1870.
109,390.—Water Wheel.—Kenyon Cox and Theodore Cox, New York city.
109,404.—Gas-Burner.—Andrew Fulton, Albany, N. Y.
109,453.—Sediment Agitator for Steam Boilers.—B. W. Reynolds, Evanville, Ind.
109,460.—Generating Gas from Hydrocarbons.—J. R. Smedberg, San Francisco, Cal.
109,510.—Apparatus for the Manufacture of Illuminating Gas. A. W. Hall (assignor to himself and E. R. Warren), New York city. Antedated Nov. 11, 1870.
109,526.—Water Pressure Regulator.—N. C. Lock, Salem, Mass.
109,534.—Pump.—J. H. McGowan, Cincinnati, O.
109,540.—Center-Seal for Gas Works.—Peter Munsinger, Philadelphia, Pa.
109,562.—Apparatus for Carburetting Air.—J. H. Van Houten, Newark, N. J.
109,568.—Gas Machine.—J. H. Van Houten, Newark, N. J.
109,582.—Globe for Gas Lights.—Charles Collier, Selma, Ala.
109,616.—Steam Generator.—John Houpt, Springtown, Pa.
109,622.—Water Elevator.—T. H. Hutchinson, Gorham, N. H.
109,645.—Steam Generator.—J. A. Miller, Boston, Mass.
109,652.—Steam Generator.—Eugen Neuman, New York city, assignor, by mesne assignments, to C. D. Tyler, Newark, N. J.
109,658.—Enamelled Cast-Iron Retort.—T. D. Philips, Casadaga, and T. S. Phillips, assignors to B. S. Brown and T. S. Philips, Buffalo, N. Y.
109,664.—Water Wheel.—Demmon Reynolds, Napanock, N.Y.
109,671.—Cock for Carbureters, etc.—Sam'l Rust, Jr., Cincinnati, Ohio.
109,695.—Water Wheel.—Wm. A. Terry, Bristol, Conn.
109,735.—Safety-Tube for Lamps.—George M. Hopkins and John A. Straight, Albion, N. Y.
109,765.—Steam Generator.—W. G. Savage, Knoxville, Iowa.
109,783.—Steam Engine.—Francis Wedge (assignor to himself and Thomas Griffith), Zanesville, O.
109,784.—Water Wheel.—G. W. Werntz (assignor to himself and H. A. Shull), Auburn, Ind.

FOREIGN PATENTS.

Applications made by Americans for British Patents for the week ending 2nd December, 1870, reported for AMERICAN GAS-LIGHT JOURNAL by our London Agents.

3016.—Coal-Boxes.—R. R. Deacon, Montreal, Canada, dated November 17th, 1870.
3049.—Steam Pumps.—W. Craig, Newark, N. J., and H. L. L. Brevoort, Brooklyn, N. Y., November 21st.
3117.—Ventilator, Alarm and Pump.—W. F. J. Thiers, P. D. Roddey, and E. P. Parkham, December 28.

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*** Reference to them is required. 204-1y

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

FRIDAY, DECEMBER 16, 1870.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subject to which its colums are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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McCRACKEN GAS PROCESS.

Recently we had the pleasure to visit New Brittain, Conn., for the purpose of examining the McCracken gas process, which is in operation in the gas works situated at that place.

New Brittain is a very pretty and thriving manufacturing town of about 11,000 inhabitants. The gas works are near the railroad depot. The retort and purifying house is a substantial brick building, with slate roof, supported by an iron frame. A wing, also of brick, has the meter room and office, and also includes an extemporized photometric room, ingeniously devised by Mr. E. D. McCracken, in order to test the candle power of the gas made by his improved process.

There are two gasholders; the old one of 15,000 cubic feet capacity, and a very nicely proportioned and well constructed holder of 110,000 cubic feet capacity, just completed by the enterprising contractor, Mr. T. F. Rowland, of the Continental Iron Works, N. Y.

The retort house contains one bench of clay sixes, and one bench of iron threes. The bench of threes is provided with the McCracken improvement for utilizing the tarry products described in the last namber of the JOURNAL.

The courteous and intelligent young engineer, Mr. E. C. Learned, and his assistants, gave us the opportunity to see the *modus operandi* of the process, which is much more simple than we anticipated.

Although previously prepossessed in favor of the *theory* of the improvement, we will confess that we expected to find, as is usual in the first trials of new inventions, crudities in the mechanical arrangement, and, possibly, serious if not vital difficulties to the practical every-day working of the process. The history of the heretofore numerous futile attempts to utilize coal tar to increase the volume and candle power of gas, both in this country and in Europe, and especially in England, since the first effort of Mr. Low in 1820, will account for this feeling of skepticism in the present instance. But to our most agreeable surprise, we could detect none of the old evils in the process. There is no choking up of stand-pipes and connections, no conglomerate of coke and solid matter in the tar retorts, and no accumulation of gas carbon. The tar retorts and connections were quite clean after over two months use, while the retorts, working as usual, had considerable incrustations, and the superintendent informed us required "burning out" once in two or three months. The coke of the tar retort was quite as good, if not better, than in the other retorts, being compact, hard, and with quite a metallic lustre when broken. We have a sample at our office that will show for itself.

The apparatus is simple, and its application requires but little expense, inasmuch as it requires no change in the ordinary settings of the benches. The tar is evidently completely utilized and converted into illuminating gas as fast as it is formed, largely increasing the volume and illuminating power of the gas. The most casual observer cannot fail to notice the high candle power of the gas, and especially the peculiar whiteness of the flame, evidently owing to the excess of olefiant gas and possibly *acetyline*, which it derives from the *decomposition of the tar in combination with the superheated steam.* We italicise the latter part of the sentence, because it is the great secret of the success of Mr. E. D. McCracken's process—the key to the enigma which all prior experimenters have sought for in vain.

Taken all in all, the trip, despite the stormy weather, was pleasant and instructive. The town is neat and picturesque, the air pure and bracing, and last but not least, Mr. Ross, of the Humphrey House, the boniface of "mine inn" where we dined, is not only genial and agreeable, but a splendid caterer, and thanks to distance, is not dependant upon the stale products of the Washington Market of New York.

ENRICHMENT OF GAS.—THE TRINIDAD BITUMEN.

The time has fully come, which has been long foreseen (by those who indulge in the unpopular and "unpractical" practice of foreseeing things), when the earth must be ransacked even to its uttermost corners, to obtain materials for that manufacture of artificial daylight which is one of our necessities, continually advancing and increasing with the march of civilization and the tide of population. Every one of the materials in which the sun has long ago locked up "the light of other days"; not only that which lighted to their prey the reptilian and batrachian monstrosities of the Mesozoic and the Carboniferous, and the sharks and ganoids of the Devonian, but even that which must have made glad the eyes of the cyclops and the trilobites of the Silurian; must soon be brought out of its hiding-place among these ancient strata, and made to fulfill the purpose for which it was stored away by the Author of All.

Many things combine to make this country of ours one in which the searching out of all possible materials of this nature is pre-eminently important. These things are so obvious that we shall spend no space in detailing them, but pass on at once to practical considerations. The necessity of possessing some material in abundance, even if rather costly, for the enrichment or "sweetening up," as some gas men graphically designate it, of the gases from poorer and cheaper coals, is one that is now constantly realized by our gas managers.

Boghead cannel was at one time employed to some extent, until it became too scarce and dear, or, rather, too valuable for the manufacture of heavy oils, paraffine, etc. Albolite has been the resort for several years past of some large companies, as in Boston, New Haven, and other cities nearer to the source of this valuable mineral; but of late it has been impossible to obtain this *at any price*, and some regular consumers who have large actual contracts, are in doubt, we are credibly informed, as to when, or whether at all, they will obtain the fulfillment of these. In fact, all experience proves that one of the first requisites, *practically* speaking, that should be considered in adopting the use of any gas material, is *abundance, certainty, promptness*, and *reliability* of supply. Otherwise, there is such risk of disappointment, leading not only to pecuniary loss, but even to what Josh Billings calls "indulgence in profane literatoor," that is, a breaking of the third commandment on the part of the public, in its intercourse with the Gas Company, that the latter ought, even in view of its own interest, to be willing to *pay* for these conditions.

There is a material prominently before the American gas world, now being largely introduced by parties in this city, which complies with this necessary prerequisite of almost *unlimited* supply, to a most eminent degree. This is the bitumen from the great Pitch Lake of Trinidad. Our readers have already had, from the pen of our distinguished geological correspondent, Dr. STEVENS, a most picturesque and instructive original account of his own personal visit to this

famous phenomenon, on the Island of Trinidad. (See *Am. Gas-Light Journal*, August 2, 1870.) From his statements of the surveys and borings made, it is easily calculated that the quantity actually *known* to exist, besides what may not be reachable by boring, amounts to the enormous bulk of 147 millions of cubic yards. This is equal to the volume of a seam of coal one yard thick, and covering 30,438 acres, or about *forty-eight square miles*. Calculating from this bulk and from the density of the mineral, as given by KEATES and LETHEBY, =1.283, we get a weight of over *forty-seven million tons*. This will last us for some time.

The amount available of this "sweetening" material being, therefore, pretty satisfactory, the next consideration pertinent is, as to its sweetening *power* and availability. The most complete examination of these questions that we find, is one made in England (where the subject is not nearly so important, however, as here,) three years since, by several eminent chemists, among them Dr. LETHEBY, and Dr. ANDERSON, Professor of Chemistry in the University of Glasgow. We cannot give room to the reports of these gentlemen, but will be satisfied here with quoting a summary made by HENRY PALFREY STEPHENSON, of the *Institution of Civil Engineers*, Fellow of the Geological Society, etc.:

"If the yield per ton of Boghead cannel be taken at 13,000 feet of 35 standard sperm candles, that of Wigan cannel at 10,000 feet of 22 candles, and that of Newcastle ordinary coal, at 9,300 feet of 13 candles, then a mixture of 20 per cent. of Boghead, with 80 per cent. of Newcastle ordinary coal, would yield per ton 10,040 feet of 18.7 candle gas; and a mixture of 20 per cent of Wigan cannel, with 80 per cent. of Newcastle ordinary coal, would yield 9,440 feet of 14.9 candle gas. You will observe from the reports before you, that with a mixture of the same proportions of Trinidad bitumen and ordinary Newcastle coal, according to Dr, Letheby and T. M. Keates, Esq., the yield of gas per ton was at the rate of 10,600 feet of 17.6 candle gas, and according to Dr. Anderson it was 10,080 feet of 16.5 candles, the difference between the two being accounted for, probably, by the use of West Leverson coal in the first instance, and North Pelton coal in the second; it will, therefore, be seen that the bitumen, as a gas-producing agent, is very superior to Wigan cannel: in fact, to produce the same rosult, it would be necessary to increase the quantity of Wigan cannel to nearly 50 per cent. The result also approaches, and very nearly equals that obtained from Boghead."

Our limits at present allow us but to add that among the several places where the Trinidad bitumen is now in use, we have visited the great works of the Brooklyn Gas-Light Co. In another article the details of these inquiries will be presented, and it will now be added only that the general experience obtained *practically* by the Brooklyn Company, on the great working scale, would indicate much better results than those reported by ANDERSON or LETHEBY, as the yield of smaller tests; inasmuch as it is actually preferred by them to albertite, hitherto regarded as about the acme of enriching agents. More in another article, in which will also be given results of confirmatory experiments made in this city, by gentlemen eminent in the gas fraternity, including Mr. WM. FARMER, whose name is familiar to all. H. W.

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Philadelphia seems destined to become the great manufacturing metropolis of the Union. The energy and enterprise of its citizens, and capitalists, in connection with its local advantages—proximity to the great coal and iron mines of Pennsylvania, its great system of intercommunication by water and by railroad, its fine commercial and business advantages, together with its salubrious climate and the large agricultural surroundings, all conducing to place it in the front rank of the manufacturing cities of America.

Among its special industries, we may mention the great iron works of Messrs. Morris Tasker & Co., who are the pioneers in the manufacture of gas works and materials. Their facilities as manufacturers and builders of gas works of every plan and description is unsurpassed. Mr. P. Munzinger, their intelligent and gentlemanly gas engineer, belongs to the "progressive school," we are pleased to say, and is capable and experienced in the business.

The advertisement of Messrs. Morris Tasker & Co., occupies the entire last page of our journal, and will be read with interest by all gas engineers and others interested in gas matters.

Some grave not to say laughable typographical errors inadvertantly occurred in this advertisement in the last issue which have been corrected in this.

THE STATEN ISLAND ORE, FOR GAS PURIFICATION.

In our last we introduced this improvement, which is now assuming, as we believe, greater practical importance than any to which our attention has been called for a long time. It was stated that this natural product, found in great quantity in the immediate vicinity of the American metropolis, combines four essential conditions of a gas-purifier to a greater degree than any other material yet used, whether natural or artificial. These fou rare *purity*, that is, large proportion of iron; *porosity*, *granular* texture, and a large proportion of *combined water*. Mineralogists recognize four compounds of peroxide of iron and water, two of which only are common, *limonite* containing 59.9 per cent. of metallic iron and 14.4 of water, and *turgite* containing 66.3 of iron, and only 5.3 of water. There are also *bog ores*, which are humates of iron, generally very impure, and not porous enough to have any marked purifying power. Most of our brown hematite ores, like those of Salisbury, Kent, etc., are largely mixed with turgite, and this of a heavy and compact variety. The Staten Island ore is a *nearly pure limonite*, of a highly porous and granular character. An analysis made by one of our most skillful American analysts, Dr. C. ELTON BUCK, (formerly editor of this journal,) gave 55.5 per cent. of iron, and 12.4 of water. In regard to porosity, it would be very difficult, and certainly very expensive, to make artificially an oxide possessing the uniform granulation and highly porous texture possessed by this.

It should be noted that, as used by ST. JOHN and CARTWRIGHT in making their composition, it has been subjected to a washing process, which has removed a quantity of fine ochoreous matter that would otherwise tend to clog the passage of the gas.

The patented device of these gentlemen, also, for increasing the permeability of the mass, *without introducing any inert matter*, by using waste borings and turnings of iron for this purpose, (instead of sawdust, straw, etc., as in European practice,) is highly ingenious and valuable. The metallic iron thus introduced is useful from the start, and is gradually converted into a highly active hydrated oxide, so that the improvement of the new composition by use, is of the most marked character. Every time it is used, after revivification, until too heavily charged with sulphur, it *improves in power* and *endurance*. (We shall very shortly lay before the public some marvellous facts under this head.) A more striking example of the "killing of two birds with one stone," has rarely occurred in the history of human invention; and it is one of those applications which, from their simplicity, excite wonder that they "never were thought of before."

There is one consideration which puts in a strong light the great importance of this new invention in America. This is, that most of our richer American gas coals are *highly sulphurous;* so much so, indeed, that purification by lime is almost impracticable on a large scale; and such coals have only been used to a limited extent in admixture with poorer coals—in point of fact, only as enriching agents. ST. JOHN and CARTWRIGHT'S improvements are destined to bring into rapid use gas made from West Virginia, Cape Breton, and other rich, but sulphurous, coals, *without admixture*. They are destined, in other words, to *cheapen candle-power*, and thus to benefit the public in a vital matter. The strongest objection that has been made to iron purification generally, by our American experts, arising out of most important chemical considerations—one which was formerly urged repeatedly by the present writer—is the comparatively feeble action of iron-purification on the carbonic acid of the gas. The writer takes this occasion to say that this objection has lost its force with him since he has recognized the fact that the richer American gas coals generally yield, when properly manipulated, gases containing but small proportions of carbonic acid. (He does not here refer to cannel, but to caking coals.) As an example, the writer would refer to his own analysis of the gas of the W. Va. "Murphy Run Coal," which gave little over one per cent. of carbonic acid, with still less of carbonic oxide. (See this Journal for June 2, 1870.) Chemically speaking, it is easy to understand why a coal highly charged with iron sulphurets, products of powerful *deoxidation*, should be almost necessarily free from oxygen in its constitution, and must, therefore, if *charged dry* into the retorts, yield a gas poor in both carbonic acid and carbonic oxide. At the same time these rich sulphurous coals are the very ones to which iron purification is practically indispensable, as in the case of the Harlem Works, where the Murphy Run is in use alone. H. W.

American Journal of Science and Arts.

In our advertising columns to-day, appears a notice relating the following circular of Messrs. SILLIMAN & DANA, which we insert as of interest to all men of science. In our next this subject will be further referred to. H. W.

Permit us to call your attention to the fact that this long established Journal—which has from its commencement been the leading vehicle for the original papers of American scientists—will be continued after the close of the present year, as a monthly journal. This increased frequency of publication will, it is believed, meet a wish often expressed by authors for a more rapid interchange of views and an earlier knowledge of the progress of research; and the Editors hope that the friends and patrons of science will aid in promoting its wider circulation. We believe that there are many public and private libraries, and reading rooms, throughout the country, which are not now supplied with this Journal, where its presence will be acceptable.

☞ TO SAVE GAS AND IMPROVE LIGHT, BUY BEGG'S GAS REGULATOR. See advertisement on this page.

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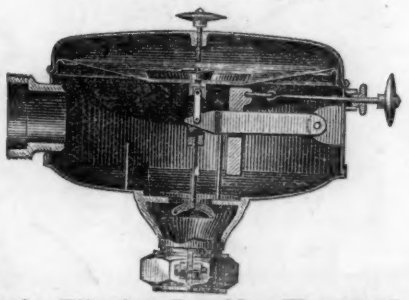

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The above cut represents a sectional view of this Governor, fully described in No. 262 of this Journal, Nov. 16, 1870.

It is made almost entirely of brass; the diaphragm is selected from choice leather, and covered with a preparation which keeps it flexible, as well as gas-tight and durable, for upwards of five years, when it can be renewed at a trifling expense, and the apparatus is again as good as new.

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Numberless testimonials can be shown to prove that it saves from 20 to 50 per cent. of gas, besides improving the character and steadiness of the light.

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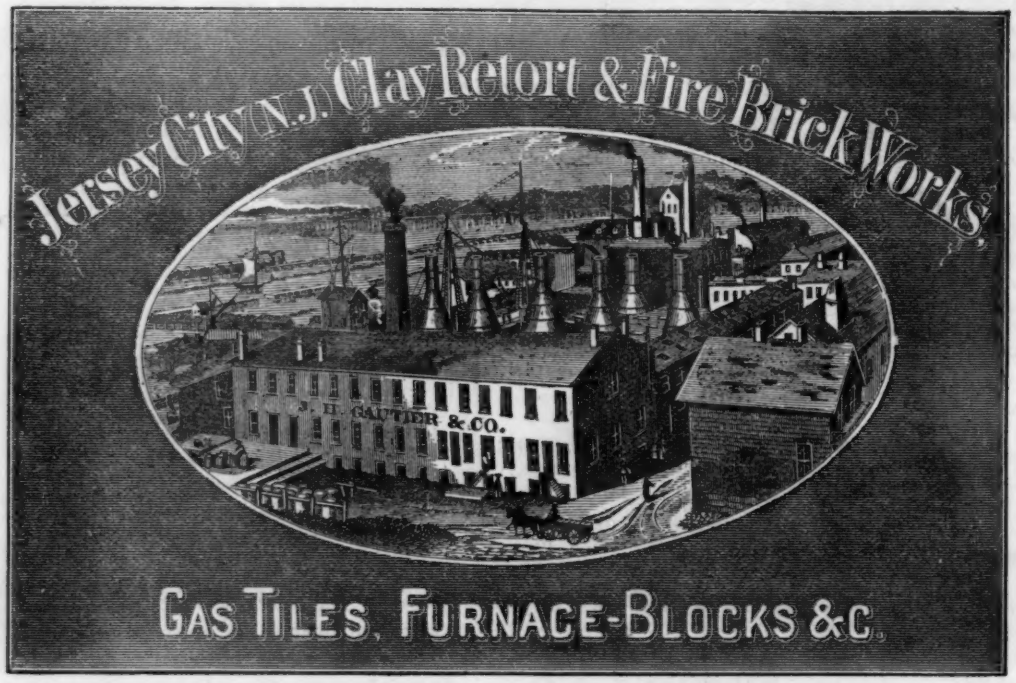

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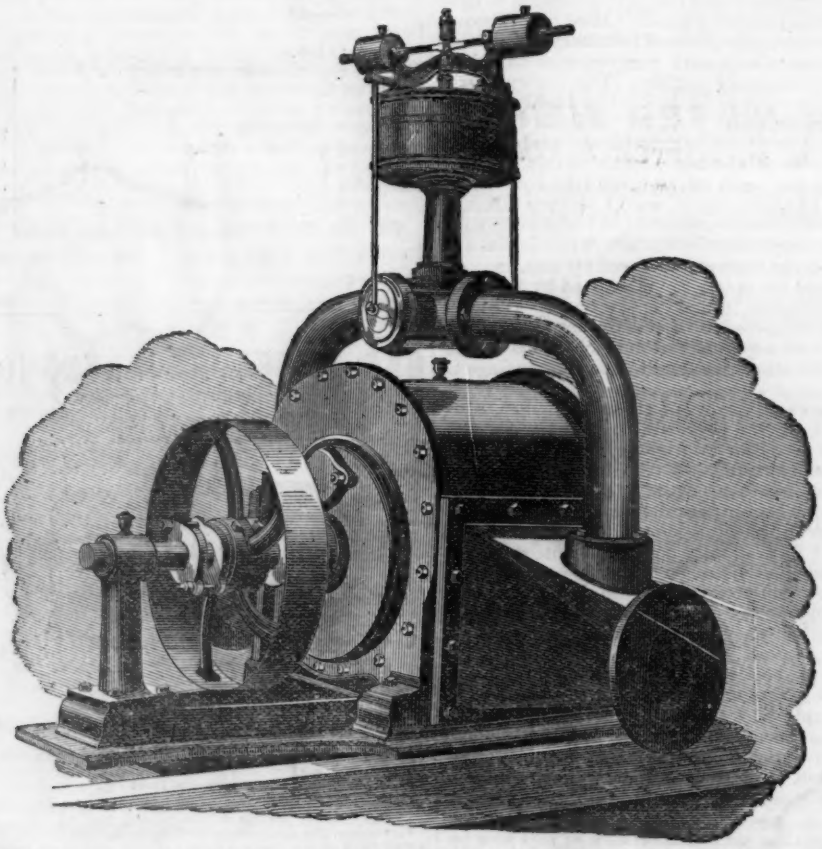

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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"DAYTON, OHIO, June 27, 1870.

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"Chairman Water Works Committee."

"CANTON, OHIO, June 27, 1870.

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"JOHN S. SHORB,
"Superintendent Water Works."

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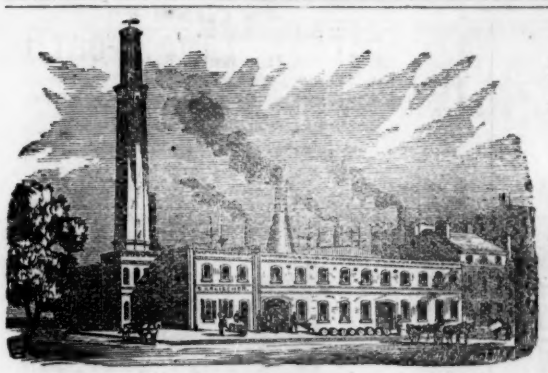

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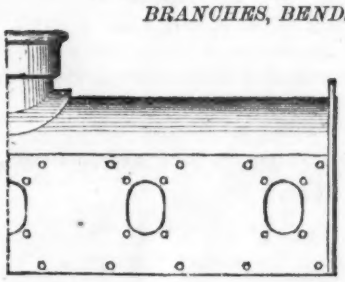

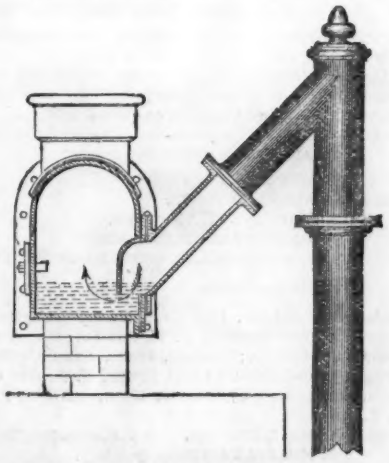

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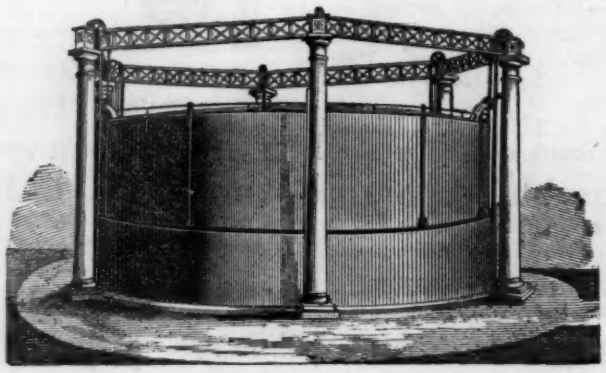

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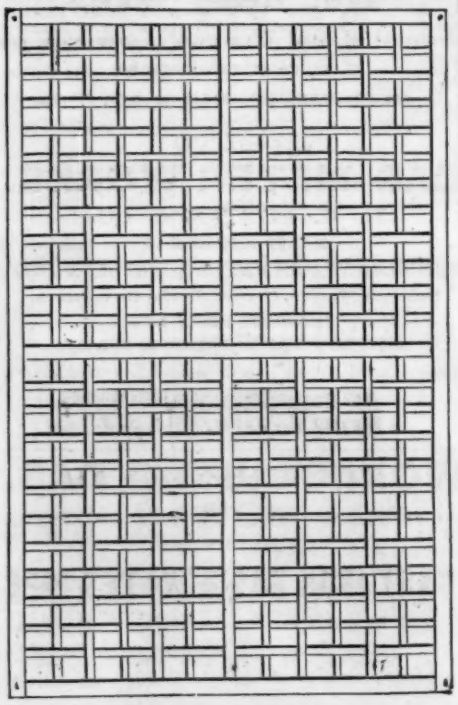
GAS SCREEN MANUF'G COMP'Y.



To Gas-Light Companies.

Your attention is respectfully called to the new and improved Patent GAS SCREEN, now being manufactured by the American Gas Screen Manufacturing Company, under the patents granted to E. DUFFEE, and are pleased to submit the following points of their excellence and superiority over all other Screens now in use.

The Screen is made with an Oak Frame, interlaced with split rattan drawn through holes at regular intervals in the Frame and cross pieces, the edges of the frame being grooved to prevent abrasion.

The advantages of the Screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the Screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

3d. The saving of lime and labor, as the Screens are not liable to clog, and are easily cleaned.

4th. Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

Testimonials.

EAST BOSTON, February 22, 1870.

Mr. E. Duffee—Dear Sir: We have used your Trays for the last five years in our works, and find them to last the longest, and give the best satisfaction of any we have ever used.

Respectfully yours,
WM. W. WEST, Supt.

CHELSEA, July 20, 1870.

Mr. E. Duffee—Dear Sir: I have used your Purifying Trays for three years, with entire satisfaction to our company. For durability and cheapness, I am convinced they are the best with which I am acquainted. By the increased purifying capacity of your Trays, it relieves the pressure on the retorts, and prevents the accumulation of carbon, and also save lime and labor.

J. M. SOMER,
Supt. Chelsea Gas Co.

DORCHESTER, March 3, 1870.

Mr. E. Duffee—Dear Sir: We have had your Gas Trays in constant use for almost one year and six months, and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours,

W. B. BROOKS,
Agent Dorchester Gas-Light Co.

BANGOR, August 2, 1870.

Edward Duffee, Esq.—Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction, and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted.

Respectfully yours,
W. H. PERRY, Supt.

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Newburyport Gas-Light Co. Mass.	Meriden Gas-Light Co., Conn.
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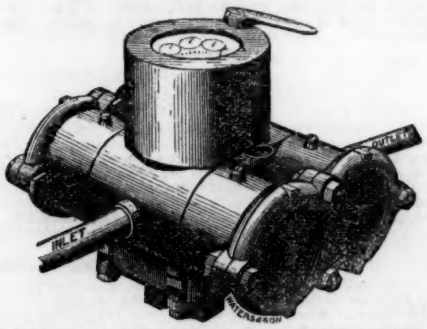

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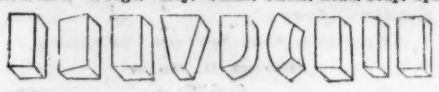

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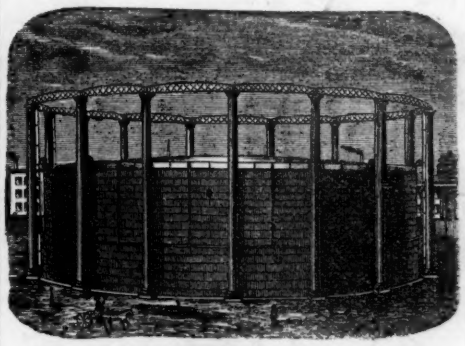

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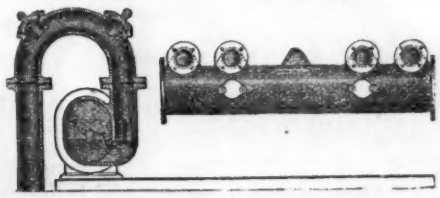

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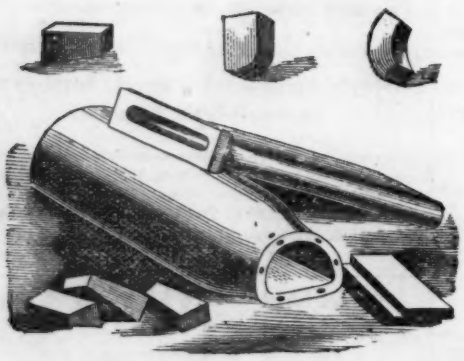

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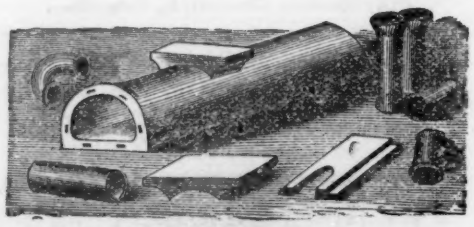

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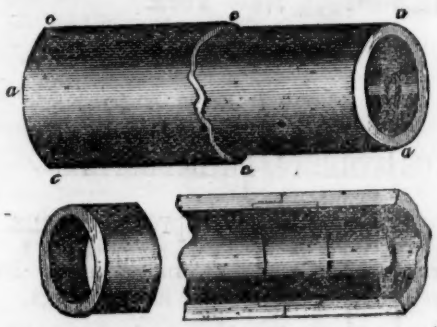

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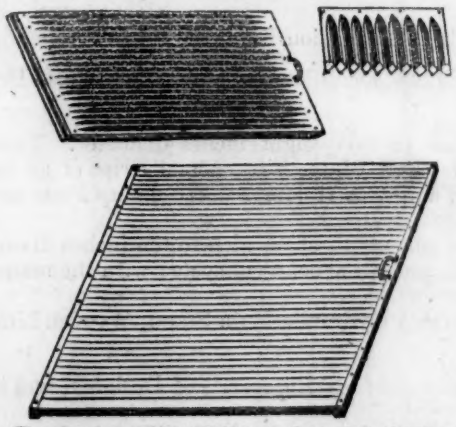

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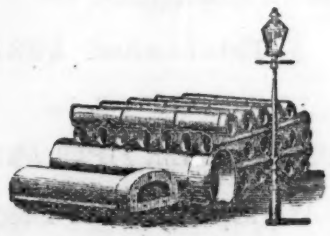

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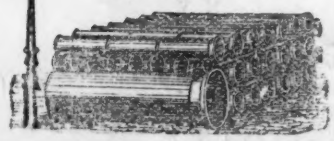

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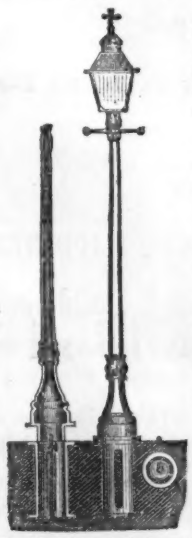

1st. The saving of the base of bottom part of the Post, when the column is broken, the Post being made in two parts. The broken column can be replaced by a new one, without disturbing the base.

2d. When the old style of post is broken, the bottom piece has to be dug out, which cannot be done in winter, or in wet weather; all this is obviated in this Post, as no digging is required. This style of Post is especially desirable when flag stone sidewalks are used.

3d. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes, no digging being required, as is now done with the old Post.

4th. A lighter and better casting can be made from this patent, and it can be handled better, owing to its length and lightness.

5th. In case a broken column cannot be repaired, one-third of the original cost is saved by the base being secured and perfect.

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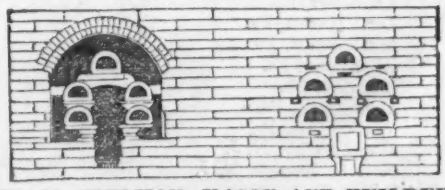

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